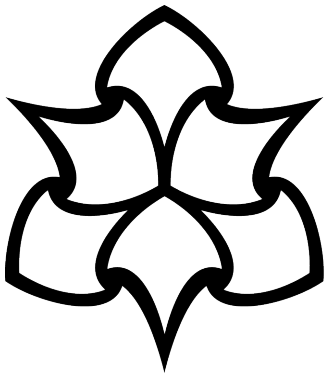

RUNNING HEAD: IRRATIONAL BELIEFS AND CHOKING

Irrational Beliefs and Choking under Pressure: A Preliminary Investigation

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Abstract

Researchers who examine existing models of choking under pressure are beginning to explore the antecedents that predispose individuals to increased anxiety. Irrational beliefs (IBs) may be one such antecedent to "choking", given that irrational beliefs are closely associated with anxiety intensity. This study aimed to investigate whether IBs influenced anxiety and performance under pressure. Experienced Australian football players (*N*=35) completed an IBs questionnaire prior to an Australian football set shot experiment with low- and high-pressure. During both pressure conditions, participants completed a state anxiety questionnaire prior to completing 15 set shots on goal. Results indicated that cognitive and somatic anxiety increased from low- to high-pressure. For somatic anxiety, an IBs main effect approached significance, indicating higher somatic anxiety with increases in IBs. A marginally significant Condition main effect was found for performance, which decreased from low- to high-pressure, with no other effects for performance evident. Follow-up correlation analysis of seven athletes who likely experienced choking (i.e., greater than 15-point performance decrease) indicated a strong negative correlation between IBs and change in performance from low- to high-pressure. Further analyses for "chokers" indicated a significant IBs x Condition interaction, with performance tending to increase with increasing IBs under low-pressure and decrease with increasing IBs under high-pressure. This study provides initial, tentative support that IBs associated with performance trends of "chokers" under different pressure conditions may be dissimilar to those of "underperformers" or "clutch" performers. Applied implications for sport psychologists working with athletes are discussed.

Keywords: Anxiety, Performance, Emotions, Rational Beliefs

Lay Summary: This paper investigated whether inflexible thoughts (i.e., irrational beliefs- IBs) led to increased anxiety and “choking”. Athletes completed an IBs questionnaire, then an anxiety survey during a football kicking task under low- and high-pressure. Results indicated IBs may affect “chokers” response to pressure differently to other groups.

Irrational Beliefs and Choking under Pressure: A Preliminary Investigation

Achieving success in sport is the result of many physical and psychological factors, but arguably one of the most important psychological factors is having the ability to perform optimally in high-pressure situations (Geukes, Mesagno, Hanrahan, & Kellmann, 2013; Ilundáin-Agurruza, 2015; Mesagno & Hill, 2013). For some athletes, however, the ability to perform successfully under pressure remains elusive, where choking under pressure (i.e., choking) may occur. The choking definition debate has developed shifting the definition from generic social roots, where choking is any performance decrement caused by an increase in anxiety (Baumeister, 1984), to more focused definitions that (in part) concentrate on a certain amount of performance decrement experienced (Hill, Hanton, Fleming, & Matthews, 2009). We adopt a more contemporary definition of choking as being a considerable skill performance decrement in an anxiety-producing situation, when that same skill is performed at a "normal" standard in low-pressure situations (e.g., Beilock & Gray, 2007; Geukes et al., 2013; Mesagno & Hill, 2013). We believe that choking is different to underperformances that may be the result of "luck" or minor errors, with choking a more substantial decrease in performance. For brevity, further explanation of the choking definition debate and ongoing contention over the precise definition can be found elsewhere (e.g., Mesagno & Hill, 2013; Mesagno, Geukes, & Larkin, 2015).

Researchers investigating choking have formulated a variety of theory-driven explanations including attentional, self-presentation, and biomechanical models to enhance knowledge of the process and outcomes of choking. In this paper, we focus on the cognitive antecedents of choking, how these antecedents influence state anxiety in a competitive situation, and specifically discuss models related to these cognitive processes, namely the two attention models (i.e., distraction & self-focus), and the self-presentation model (Mesagno, Harvey, & Janelle, 2011, 2012). We focus on the antecedents of choking in order to

determine other personality characteristics specifically linked to increased anxiety that may predict choking-susceptibility, which is the foundation of the self-presentation model (Mesagno et al., 2011, 2012) that focuses on the origins of anxiety increases under pressure.

The distraction model of choking was developed by researchers (e.g., Hardy, Mullen, & Martin, 2001) who theorized that increased state anxiety in competitive situations may cause task-irrelevant information to intrude and compete with salient task-relevant cues for the limited resources available in working memory. In high-pressure situations, athletes are unable to allocate the amount of working memory capacity required for the task, leading to an attentional shift towards anxiety-related irrelevant cues, which decrease performance. This theory has been expanded to incorporate the processing efficiency theory and its successor, the attentional control theory (ACT; Eysenck, Derakshan, Santos, & Calvo, 2007). Researchers advocating for the ACT suggest that as anxiety increases, attention is directed towards threat detection and generation of a response to the threat. This diversion of cognitive resources is hypothesized to decrease attention paid to task-relevant processes, resulting in a performance decline (Eysenck et al., 2007).

Alternatively, advocates of the self-focus model or the explicit monitoring theory (e.g., Baumeister, 1984; Beilock & Carr, 2001; Masters, 1992) proposed that the decrease in performance under pressure stems from an over-awareness of the movement action itself (Beilock & Gray, 2007; Mesagno et al., 2015). This occurs as self-consciousness increases alongside anxiety about correct task execution and leads to a step-by-step monitoring of the task (Beilock & Carr, 2001). Experienced execution of tasks are usually processed outside of conscious awareness and, as such, are automatic, but “reinvestment” (Masters & Maxwell, 2008) in learned skills and excessive attention on skill movement breaks down automaticity, which leads to decreases in performance. Building on explanations of self-focus models, Jackson, Ashford, and Norsworthy (2006) hypothesized that performance declines are due to

increasing attempts to consciously control the processes involved in the task rather than just task monitoring alone (Mesagno et al., 2015).

These attention-based models consider the cognitive processes that follow heightened anxiety, but the self-presentation model (Mesagno et al., 2011, 2012) focuses on the antecedents, specifically personality characteristics, which may explain the rise in anxiety prior to the attention-based models. Self-presentation is the process by which people attempt to monitor and control how they are perceived and evaluated by others (Schlenker, 1980). A key assumption of the self-presentation model is that psychological traits, such as self-consciousness and fear of negative evaluation, may lead to athletes' increased perceptions of being judged by others and concerns over portraying a specific image of oneself to others (Mesagno, et al., 2011, 2012), which leads to an increase in perceived pressure to perform well. When athletes perceive that their public self, or how they appear to others, will be (negatively) judged based on the outcome of the task, state anxiety can be exacerbated, potentially leading to the cognitive outcomes suggested by the distraction and self-focus models of choking (Mesagno et al., 2011, 2012). More recently, Hill, Carvell, Matthews, Weston, and Thelwell (2017) conducted a qualitative investigation of nine elite athletes' choking (and clutch performance) experiences and extended the self-presentation model. Hill et al. found the majority of athletes (in their study) held protective-agentic self-presentation motives (i.e., the desire to avoid social disapproval from others in terms of physical qualities and task ability; Howle, Jackson, Conroy, & Dimmock, 2015) and low self-presentation efficacy (i.e., doubted their ability to maintain a favorable impression) during choking. This extends the self-presentation model by providing evidence that chokers may have low belief in their ability to portray a positive image of being an elite athlete and instead process thoughts about avoiding disapproval from important others (e.g., selectors or coaches) about their athlete capabilities (e.g., ability to performance well under pressure).

Based on the above research, extensive evidence exists to support the distraction and self-focus models, which provide explanatory links between anxiety and dysfunctional attention. The self-presentation model attempts to explain why precursors of choking lead to heightened anxiety, which may lead to distraction or self-focus explanations, but has received limited research attention/ support to date. Nevertheless, there is a gap in our knowledge related to specific cognitive antecedents that produce the level of anxiety where choking occurs. One group of cognitions that has been associated with similarly high levels of anxiety to those present when athletes experience choking are irrational beliefs (IBs).

Beliefs, in their broadest sense, are classified as irrational or rational, are complex, and represent personal deep cognitions (Dryden, 2009; Turner, 2016; Wood, Barker, & Turner, 2017). Rational beliefs are described as personal views that express a preference for a desired outcome but are flexible and adaptive in their acceptance of non-preferred outcomes (Davies, 2008). Individuals who have rational beliefs can, through acceptance, acknowledge the potential for negative outcomes and understand that negative outcomes do not signal catastrophic consequences, leading to functional emotional and behavioral outcomes (Dryden, 2009). Conversely, IBs are described as unreasonable, unfalsifiable, and rigid thoughts that lead to an inflexible lack of acceptance for non-preferred situational outcomes (Davies, 2008). Individuals with IBs demonstrate unhealthy adverse emotions and maladaptive behavior, possibly because of an over-investment in a specific, desirable outcome and an inflexibility to accept a non-desired alternate outcome (David, Lynn, & Ellis, 2009; Dryden, 2009; Turner & Barker, 2014).

Irrational beliefs take the form of one primary IB and three secondary IBs (Turner et al., 2016; Turner, Slater, & Barker, 2014). The primary IB, “demandingness”, categorizes a belief as being rigid, unchanging, and absolute (Dryden, 2009) placing a demand on the self, others, or situation. Generally, the demand is often conceptualized as a rigid “must” or

"should", for example, "I must kick this goal" (Turner et al., 2014). The individual's rigidity to the situation indicates the extent of the investment to their preferred outcome (Dryden, 2009). When less desirable, actual outcomes occur, the individual will have a strong negative emotional response (Dryden, 2009).

Having met this first primary categorization, IBs can then be further characterized into how the belief is framed and judged. The three secondary IBs are "awfulizing", "low frustration tolerance", and "depreciation" (David et al., 2009). Awfulizing IBs focus on the less desirable outcomes of a specific event occurring, ignoring or denying any positive alternate outcomes (Dryden, 2009), leading to an individual framing the consequences as disastrous when the initial demand is not met (e.g., "It will be catastrophic if I do not kick this goal"). Low frustration tolerance IBs center on the individual's inability to accept undesirable, non-preferential outcomes and highlight the intolerable, frustrating, and uncomfortable aspects that would come from potential failure (David et al., 2009; Dryden, 2012). A low frustration tolerance IB statement might be, "I will not be able to bear it if I do not win this match". Depreciation IBs are directed toward the agents that are involved in the event occurring, such as self, others, or surrounding environment. Depreciation IBs involve an unreasonable judgement that the sole worth of the individual, group, or environmental factor relates to the event outcome, with an example being "I am a bad person if I do not score highly in this round" (Dryden, 2009; Turner et al., 2014).

Although researchers have investigated the potential for IBs to play a role in sport, IBs research has been examined in a broader context of anxiety and yielded promising leads. Focusing on clinical anxiety symptomology, studies have identified positive associations between IBs and anxiety symptoms (Chang & D'Zurilla, 1996; Harrington, 2005). Within anxiety-predisposing personality trait research, high levels of generalized IBs were associated with high levels of trait anxiety (Lohr & Bonge, 1981; Zwemer & Deffenbacher, 1984).

Malouff, Schutte, and Mclelland (1992) reported positive associations between state anxiety and generalized IBs scores, with researchers also finding that higher generalized IBs predict higher state anxiety in academic settings (e.g., Boyacioglu & Kucuk, 2011; Cramer & Buckland, 1995; Tobacyk & Downs, 1986). Additionally, consciously holding IBs in mind has been positively linked to increased physiological responses and psychological anxiety (Harris, Davies, & Dryden, 2006). When investigating IBs, researchers have used the "multi-dimensional", generalized IBs scores for associations with anxiety variables (e.g., Turner & Barker, 2013). In fact, the main corpus of Rational Emotive Behavior Therapy (REBT) literature has used general IBs (i.e., composite) to examine REBT, IBs, and concomitant emotional and behavioral consequences (Turner, 2016) and thus we have adopted this approach especially considering the preliminary nature of this study.

Given the relationship that generalized IBs have on dysfunctional emotional responses (especially anxiety) and the detrimental effect elevated anxiety has on choking (e.g., Mesagno et al., 2015), it follows that in sport, IBs about the self and the performance environment could cause increased anxiety, which may lead to deleterious performance. This is especially important considering the link between IBs and performance in other domains is non-existent (or unclear at best). For example, athletes who are high in traits related to self-presentation and have performance-relevant IBs, such as "I must be respected by members of my team" and "I'm a failure if I do not perform well under pressure," may perceive performing in competition (and in front of "friendly faces" in particular) to be threatening, which could intensify anxiety levels. The threat experienced may relate to the positive relationship between IBs and social anxiety (Davison & Zighelboim, 1987; Turner, Ewan & Barker, 2018), which arises from a perception of potential scrutiny by others (Leitenberg, 1990). In fact, one recent sport study demonstrated that athletes with high social anxiety who adopted more "rational" beliefs were able to reduce social and sport-specific anxiety (Turner,

Ewan, & Barker, 2018), which may be in support of (and opposite to) IBs leading to increased anxiety suggested above. Situation-specific IBs are likely to convey a rigid, inflexible need to perform well in front of audiences and if a non-preferred outcome occurs, it could be devastating to the athlete identity (as conveyed through aspects of the self-presentation model of choking; Mesagno et al., 2011, 2012). The athlete, knowing the investment placed on their athlete identity, may then focus on their inability to accept, adapt to, and cope with failure, which may result in self- and/or relational devaluation. Self-presentational concerns, which may be exacerbated by IBs, are likely to evoke higher anxiety leading to a focus on the threat of poor performance, and may increase the athlete's vulnerability to experience choking through attention-based (i.e., self-focus or distraction) choking models.

It seems logical that athletes in an outcome-focused environment, such as competitive sport, could easily shift from rational adaptive beliefs to IBs. In sport, an irrational shift from "want to" to "have to" occurs easily due to the pressure of competitive performance and an obsession with results (Botterill, 2005). Because athletes may have a strong preference to succeed, applying some external pressure to the athlete (such as funding jeopardy) can transform the desire into a need, which is an IB that may exacerbate anxiety levels (e.g., Turner, Carrington, & Miller, 2019). Therefore, the athletic environment would be a relevant setting to investigate the role of IBs on performance.

Researchers who initially investigated IBs in sport focused on either using REBT as a form of therapy for IBs and anxiety reduction leading to performance improvement (Turner & Barker, 2013; Turner, 2016; Turner et al., 2014; Wood, Barker, & Turner, 2017), or manipulate self-talk as a possible pathway to investigate IBs (Turner, Kirkham, & Wood, 2018; Wood, Barker, Turner, & Higgins, 2017). Sport psychology researchers, however, have not yet directly examined how IBs interact with anxiety and sport performance. Investigators

who have used REBT to reduce IBs and anxiety with athletes have reported reductions in IBs and performance-related cognitive anxiety without performance being assessed, thus conclusions between reduced anxiety and performance could not be determined (Cunningham & Turner, 2016; Turner & Barker, 2013; Turner et al., 2014; Turner, Kirkham, & Wood, 2018). Wood, Barker, and Turner (2017) included objective performance markers in a case study with one national level archer when investigating the longer-term influence of REBT in the reduction of IBs. Wood, Barker, and Turner reported that the elite archer demonstrated decreased IBs, increased rational beliefs, improved self-efficacy, and improved competitive performance following the intervention. This result should be interpreted with caution, however, considering it was a case study on a single elite athlete.

Researchers have found equivocal results when investigating the role of IBs in sport performance using either single-case (with multiple cases), or experimental, designs. These studies, however, were limited by the use of self-talk as a pathway to understanding beliefs and not directly measuring rational beliefs or IBs. Nevertheless, Turner, Kirkham, and Wood (2018) reported that skilled golfers demonstrated enhanced performance in a rational self-talk condition in comparison to baseline or irrational self-talk condition, Wood, Barker, Turner and Higgins (2017) found no difference in performance with irrational or rational self-talk for novice golfers, and Wood, Barker, Turner, and Sheffield (2018) reported that eight Paralympians found irrational self-talk could be useful for sports performance in a single-case design. Turner and Barker (2014) theorized that there may be potential for IBs to be helpful in sport and provided the IB example, “I must succeed” (p. 87) as a belief that could drive athletes’ performance toward attaining a goal. Turner (2016), however, suggested that existing research indicates that even if IBs may inspire effort, there are numerous risk factors that could emerge as a result such as negative effects on physical and mental health (e.g., Turner et al., 2019; Visla, Flückiger, Holtforth, & David, 2016).

The sparse existing research on the effects of IBs on athletic performance (and also in other domains) indicates a need to better understand whether, and to what extent, IBs influence performance under pressure. The detrimental effects of IBs on psychological health have been established (see Visla et al., 2016, for a meta-analysis) but understanding the extent to which IBs influence sport anxiety and performance under pressure has not been explored and has valuable implications for performers and practitioners. Considering that heightened anxiety is a key factor for choking and a strong positive link exists between IBs and anxiety in broader research and also in sport, we would expect choking to occur in athletes with increasing IBs.

Aims and hypotheses

Thus, the aim of the current study was to investigate whether performance-related generalized IBs influenced cognitive and somatic anxiety, and choking during a set shot goal-kicking task under two levels of pressure. It was hypothesized that:

1. the level of cognitive anxiety reported would a) be higher in the high-pressure condition than the low-pressure condition, b) increase with increasing level of IBs, and c) increase with increasing level of IBs more in the high-pressure condition than the low-pressure condition (interactive effect).
2. the level of somatic anxiety reported would a) be higher in the high-pressure condition than the low-pressure condition, b) increase with increasing level of IBs, and c) increase with increasing level of IBs more in the high-pressure condition than the low-pressure condition (interactive effect).
3. the level of performance would a) be lower in the high-pressure condition than the low-pressure condition, b) decrease with increasing level of IBs, and c) decrease with increasing level of IBs more in the high-pressure condition than the low-pressure condition (interactive effect).

Method

Participants

Thirty-five Australian football (AF) players from four semi-professional, competitive football clubs in Melbourne, Australia participated. All athletes were male, over the age of 18 (M_{age} = 24.49, SD = 3.67), and had at least five years of playing experience at a semi-professional, competitive level ($M_{experience}$ = 12.8, SD = 3.02). Participants were excluded if they had any existing injuries that could affect performance.

Equipment and scoring

Participants used a full-sized Australian football league (AFL) standard football. The performance target consisted of four AFL regulation size goal posts on a grass AFL oval, six 2.6-metre-high Nyda Portable AFL goalposts, and 20 meters of rope. Cones were used to identify the required kicking positions, and a JVC Camcorder Player GR-DV2000 MiniDv used to record participants in the high-pressure condition.

The central scoring zone was separated into scoring areas using portable AFL goal posts spaced at 2.1 meters apart (see Figure 1; letter Z). A maximum score of 10 points was awarded for a kick through the center gap, nine points awarded for a kick going directly above or colliding with either pole that created the center gap, eight points awarded if the ball travelled through either of the adjacent gaps from the central gap with a gradual decrease in points awarded for kicks towards the peripheral scoring areas. If a participant kicked outside the scoring area, the resulting score was zero. A rope was hung at a height of 2.6m (Figure 1; letter U) to enhance ecological validity of the task because this height represented an opposing player interrupting the flight of the ball at the goal line (Beseler, Mesagno, Young, & Harvey, 2016). A final score was generated by summing the scores for the 15 kicks, with the maximum score being 150 points and the minimum 0 points.

Insert Figure 1 near here

Measures

Demographics questionnaire. The demographic questionnaire included questions about age, gender, years playing AF, predominant playing position, highest level played, amount of training per week, whether they had previously consulted with a sport psychologist, and current injuries that may affect performance.

Irrational Performance Beliefs Inventory (iPBI; Turner et al., 2016). The iPBI is a brief psychometric tool developed to measure IBs in a performance domain, with 28-items comprising seven statements for each of the four (i.e., demandingness, awfulizing, low frustration tolerance, and depreciation) categories of IBs. Each item is measured on a 5-point Likert scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) with higher scores indicating higher levels of IBs. A composite score is generated by averaging all subscale scores (with a composite score ranging from 7 to 35) and was used as the measure for the present study. Turner et al. (2016) reported the iPBI to have good criterion, construct, and concurrent validity, and acceptable Cronbach's alpha reliability coefficients for each core IB ($\alpha > 0.8$). In the present study, the Cronbach's alpha for the composite scale (α=0.828) was acceptable (Nunnally & Bernstein, 1994).

Mental Readiness Form-3 (MRF-3; Krane, 1994). The MRF-3 is a 3-item instrument designed to measure competitive state anxiety using a visual analogue scale (Krane, 1994). The scale consists of three separate 100-millimeter lines, anchored between *relaxed* and *tense* for somatic anxiety, *calm* and *worried* for cognitive anxiety, and *confident* and *not confident* for self-confidence. Participants place a mark on each line to illustrate how they feel during a specific moment with scores ranging from 0 to 100. A high score indicates higher anxiety levels. Since anxiety intensity was the focus, we excluded the self-confidence subscale. While psychometrically sound state anxiety scales, such as the Competitive State Anxiety Inventory-2 (Martens, Burton, Vealey, Bump, & Smith, 1990) can be used, these

scales take extra time to complete. Thus, the MRF-3 was chosen because it requires a short time frame for completion. The MRF-3 has been reported to have concurrent validity to the CSAI-2 demonstrating correlations of 0.76 between the MRF-3 and CSAI-2 cognitive anxiety subscales, and 0.69 for somatic anxiety subscales (Krane, 1994). The MRF-3 has also been suggested to reliably report state anxiety levels (Wilson, Wood, & Vine, 2009).

Procedures

Following the University Human Research Ethics Committee approval, participants were recruited, and informed consent provided. Upon arrival, participants completed a demographic form and the iPBI, followed by explicit instructions on the two-stage task and the scoring system with time incorporated for questions. The initial stage, for all participants, was the low-pressure condition. Participants performed a warm-up and then were given a random kicking position order with five kicks performed in a row at each of the three kicking positions (see Figure 1). After the first five kicks, participants completed the MRF-3 and then completed the remaining 10 kicks from the randomly ordered positions. During this condition, each participant was tested without the presence of other team members or peers.

The high-pressure condition followed an identical protocol to the low-pressure condition but incorporated three pressure manipulations to induce additive anxiety effects. The first pressure manipulation consisted of a three-participant silent audience. Previous research (Butler & Baumeister, 1998) reported that an audience encompassing “friendly faces” (e.g., teammates) elevates anxiety levels and creates more anxiety than monetary incentives alone (Mesagno et al., 2011). Thus, teammates were used (see Figure 1 for position relative to kicker) but the audience members did not interact with the kicking participant and raised their hands in the air as if to intercept kicks (but not so much as a distraction task). Second, a clearly visible video camera was placed on the front side (and in full view) of the dominant kicking foot of the participant. Participants were informed that the

recording would be used for students to analyze the biomechanics of their kicks, although the video recording was deleted without further analysis. Lewis and Linder (1997) successfully demonstrated that videotaping individuals elevated anxiety levels. Third, researchers have demonstrated that small monetary rewards and the presence of a video-taping performance may induce pressure (Beilock & Carr, 2001; Masters, 1992), yet only when evaluation from others is likely (Mesagno et al., 2011). Thus, participants were allocated into pairs with an unknown teammate and told they would be competing for a monetary prize (AU$50 grocery store voucher), which would be awarded to the pair with the top score at the end of the study. Before the commencement of the high-pressure condition, participants were informed that their partner had performed well in the task, and so the monetary reward was theirs to lose, it was intended to further elevate anxiety levels through self-presentation effects (Mesagno et al., 2011). Following completion of both conditions, participants were thanked and debriefed, with manipulations and deceptions explained and time provided for questions.

Data analysis

For each of three measures (cognitive anxiety, somatic anxiety, and performance), the relationship with condition (low-pressure, high-pressure) and the IBs measure were analyzed in a repeated measures analysis of covariance (RMANCOVA), with condition as a within-subjects factor and IBs as a between-subjects covariate. In accordance with accepted statistical practice, to avoid numerical problems, which can lead to spurious results, the IBs covariate was first centered, by subtracting the mean from each observed value. The measure of effect size used is partial eta-squared, for which Cohen's interpretative thresholds are: <0.01 = negligible; 0.01-0.059 = small; 0.06-0.139 = medium; and ≥ 0.14 = large (Cohen, 1988). Subsequently, the moderating effect of IBs on the effect of the pressure condition on performance was further investigated using correlation analysis, followed by a simple effects analysis within two groups of subjects characterized by the magnitude of the difference in

performance under the two pressure conditions. This analysis was completed to test for further "choking" effects based on Mesagno and Hill's (2013) conceptualization.

Results

Table 1 shows means and standard deviations for each of the three measures (dependent variables) in the two conditions. These results indicatively support hypotheses 1a and 2a (higher anxiety in the high-pressure condition) and hypotheses 3a (performance in the high-pressure condition).

Insert Table 1 near here

The basis of inferential tests was RMANCOVA models fitted for each of the three dependent variables. Normality tests (Kolmogorov- Smirnov and Shapiro-Wilk) were performed on residuals from the RMANCOVA models, and results indicated that the assumptions of normally distributed random errors were violated for all dependent variables in one or another or both conditions. Residuals for cognitive anxiety, and somatic anxiety models exhibited positive skew, and residuals for performance were negatively skewed. In accordance with recommended practice (e.g., Field, 2013; Tabachnick & Fidell, 2013), the square root tansformation (SQRT(untransformed variable)) was applied to positively skewed variables, while an appropriately modified square root transformation of the form (constant - SQRT ((maximum value of the untransformed variable)-(untransformed variable)) was applied to the negatively skewed variable. The RMANOVAs were rerun on the transformed variables, and testing of residuals demonstrated general conformity to normality, with only one marginally significant departure from normality, and so the results from the models fitted to the transformed data are reported. The inferential results for each of the three transformed dependent variables regarding the main effect of condition, the main effect of IBs and the interaction of IBs and condition, are as follows.

For cognitive anxiety, there was a significant Condition main effect, $F(1, 33)=7.30$, $p=0.01$, partial $\eta^2=0.18$, which indicated an increase in cognitive anxiety from the low-pressure to high-pressure condition. There was no significant IBs main effect, $F(1, 33)=1.09$, $p=0.30$, partial $\eta^2=0.03$, and no significant IBs x Condition interaction, $F(1, 33)< 0.01$, $p=0.95$, partial $\eta^2<0.01$. Hypothesis 1a was supported, but hypotheses 1b and 1c were not.

For somatic anxiety, there was a significant Condition main effect, $F(1, 33)=13.50$, $p<0.01$, partial $\eta^2=0.29$, which indicated an increase in somatic anxiety from low- to high-pressure. The IBs main effect approached significance, $F(1, 33)=3.43$, $p=0.07$, partial $\eta^2=0.09$, with positive regression parameter estimates for both conditions (0.14 and 0.23, respectively), showing some indication that somatic anxiety tended to increase with increasing IB. There was no significant IBs x Condition interaction $F(1, 33)=0.46$, $p=0.50$, partial $\eta^2=0.01$. Hypothesis 2a was supported, and there were weak indications consistent with hypothesis 2b, but hypothesis 2c was not supported.

For performance, the Condition main effect was on the cusp of statistical significance, $F(1, 33)=4.14$, $p=0.05$, partial $\eta^2=0.11$, with performance decreasing from low- to high-pressure. The regression parameter estimates of the IBs covariate were positive for both conditions (0.06 and 0.13, respectively), indicating that performance tended to increase with increasing IBs, but the main effect was not significant $F(1, 33)=2.44$, $p=0.14$, partial $\eta^2=0.06$. There was no significant IBs x Condition interaction, $F(1, 33)=0.27$, $p=0.67$, partial $\eta^2=0.01$. Hypothesis 3a was supported, but hypotheses 3b and 3c were not.

A scatterplot of the magnitude of the performance difference under the two pressure conditions against the IBs score (Figure 2) showed that while for the overall sample there was no relationship, for the seven participants whose performance score declined by more than 15

points (i.e., an average of one point per kick[1]), there was a strong negative association. This was confirmed by correlation analysis whereby this group (termed "chokers") had a correlation of $r = -0.87$ (p=.02), while for the remaining 28 participants exhibited a correlation of r=0.01 (p=.95).

Insert Figure 2 near here

When the RMANCOVA analysis of performance was run for the seven chokers, the Condition main effect was highly statistically significant, $F(1, 5)=105.4$, $p<0.001$, partial $\eta^2=0.96$, with performance decreasing from the low- to high-pressure condition. This was expected, since "chokers" were chosen on the basis of a large performance change. There was no statistically significant main effect for IBs, $F(1, 5)=0.003$, $p=0.96$, partial $\eta^2=0.001$. However, there was a significant IBs x Condition interaction, $F(1, 5)=10.97$, $p=0.02$, partial $\eta^2=0.69$ (see Figure 3). The regression parameter estimates for the IBs covariate were 0.22 for the low-pressure and − 0.24 for the high-pressure, indicating that performance tended to increase with increasing IBs under low-pressure, but tended to decrease with increasing IBs under high-pressure.

Insert Figure 3 near here

Discussion

The purpose of the current study was to investigate whether, and to what extent, IBs affect athletes' anxiety, and performance under pressure. In particular, it was hypothesized that the level of cognitive and somatic anxiety would increase for athletes with increasing levels of generalized IBs more in the high-pressure than the low-pressure condition. This hypothesis was not supported; all athletes experienced similarly increased anxiety under high-pressure irrespective of their level of generalized IBs. The collective group analysis

[1] This quantity of performance decline was selected after taking into consideration the nature of the task, athletes' skill level, distance between scoring zone, and decided that one point reduction per kick (on average) was a "considerable" (Mesagno & Hill, 2013) decline in accuracy as a result.

indicated cognitive and somatic anxiety increased as a result of the high-pressure, which included evaluation and monetary incentives, compared to the low-pressure. This supports the inclusion of evaluation as a pressure manipulation (Mesagno et al., 2011). It was also expected that the level of performance would decrease with increasing level of generalized IBs more in the high- than the low-pressure condition. This hypothesis was also not supported. To further investigate choking, data from seven participants whose performance score declined by more than 15 points from low- to high-pressure condition were analyzed further. Results indicated a strong negative correlation between IBs score and performance change scores, with further analysis indicating that performance tended to increase with increasing IBs under low-pressure, and decrease with increasing IBs under high-pressure; an interaction effect between IBs and pressure for the chokers only.

Dysfunctional emotional responses have been found to be a key consequence of IBs within the REBT framework (Dryden, 2009; Malouff et al., 1992; Turner & Barker, 2013), with research consistently reporting the positive association between IBs and increased state anxiety under high-pressure, performance-specific conditions (Malouff et al., 1992; Tobacyk & Downs, 1986). Existing studies, mainly within the context of school and college level exams, indicate that high IBs lead to increased state anxiety (Boyacioglu & Kucuk, 2011; Cramer & Buckland, 1995; Malouff et al., 1992; Tobacyk & Downs, 1986). The results from this initial choking-specific sport study indicate that IBs may not affect context-specific anxiety, which is contradictory to the existing consensus within IBs research (Boyacioglu & Kucuk, 2011; Malouff et al., 1992; Tobacyk & Downs, 1986).

Arguably, our study may not have achieved the expected collective change in anxiety levels that led to choking via IBs because the pressure manipulation was not similar to the competition anxiety experienced in “real-world” situations. Observing “considerable” (based on the Mesagno & Hill, 2013 definition) decreases in performance using laboratory-based

pressure is always a concern with choking research. Future researchers using "real-world" pressure may show even larger anxiety effects that influence athletes with tendencies toward increased generalized IBs scores. Nonetheless, these results provide tentative evidence for possible links between IBs and choking that researchers could investigate more in future.

This study was one of the first choking studies (to our knowledge) to find "reverse" choking-specific results for IBs and performance in a subsample of chokers compared to the results of all participants collectively. The relationship between IBs and performance of chokers tended to be opposite depending on the magnitude of pressure experienced. Based on Mesagno and Hill's (2013) choking definition and considering the athlete skill level and task complexity, we used a 15-point decrease in performance from the low-pressure condition since that equates to at least 1-point performance decrease on each attempt. As emphasized in Mesagno and Hill (but originally introduced in Hill et al., 2009), choking involves a considerable (rather than any) decrease in performance, which may also show differences in athlete cognitions. The "opposite" results of chokers from low- to high-pressure provides some tentative support for the existence of differences between those who experience choking versus "underperformance" or "clutch" performances. Specifically, IBs may influence performance under different levels of pressure only for those individuals whose performance decrement under high pressure lie above a threshold value. Thus, we would encourage researchers to investigate subsamples of chokers in future investigations.

Athletes who tended to report higher performance-related IBs were hypothesized to produce a performance-relevant dysfunctional emotional response (Dryden, 2009; Malouff et al., 1992), which would then lead to poorer performance under pressure. In the collective analysis, there was little evidence of athletes who self-reported higher IBs demonstrating performance decreases under high-pressure conditions. One potential explanation may be related to the motivational nature of IBs. That is, Wood, Barker, Turner, and Higgins (2017)

explained that if individuals with higher levels of IBs are motivated to achieve an inflexible outcome goal, then they will attempt to perform the task to a high level because of that specific IB. Within the chokers analysis in this study, however, explanations may be dependent on the pressure experienced. Chokers had a range of IBs scores that might be categorized within a "moderate" level (based on Turner & Allen, 2018 data of 312 male athletes, which is similar to our male sample), but chokers with higher IBs tended to perform more successfully when little, to no, pressure was induced. Under increased induced pressure, however, chokers with higher IBs tended to have a more substantial decrease in performance from low- to high-pressure. It seems unlikely that IBs alone harm athletic performance, since high IBs have been observed in elite samples (Turner et al., 2019), but it may be the interaction of IBs with the perceived pressure that drives different cognitive evaluations (e.g., challenge and threat) of the event (Chadha, Turner, & Slater, 2019) for chokers.

Chokers' results could be explained by combining IBs concepts, the self-presentation model of choking (Mesagno et al., 2011, 2012), and the binary theory of emotional distress (BTED; David, Lynn, & Ellis, 2010). In brief, in the BTED, not all "negative" emotions are considered disturbed or targets for change (DiGiuseppe, Doyle, Dryden, & Backs, 2014). Although unwanted (for the most part), negative emotions are an essential part of both adaptation and coping in the face of adversity. REBT theorizes that there are two distinct categories of emotional distress: healthy negative emotions (i.e., adaptive) and unhealthy negative emotions (i.e., maladaptive; Dryden, 2009, Ellis, 1994). Negatively-valence emotions are either disturbed, dysfunctional, unhealthy, and maladaptive, or they are non-disturbed, functional, healthy, and adaptive. To be clear, according to BTED, healthy anxiety is not anxiety that is *perceived* as facilitative. Rather, healthy anxiety is behaviorally functional for goal attainment because it is associated with adaptive action tendencies (e.g., preparing fully for the event, staying focused on the task and in the present moment) that may

drive approach behaviors as opposed to avoidance behaviors (e.g., rushing performance preparation and/or execution) associated with unhealthy anxiety (Dryden & Branch, 2008) .

Since chokers may have a strong preference to succeed and/or be viewed favorably emanating from a strong athlete identity and fear of negative evaluation (Mesagno et al., 2012), perhaps (albeit speculative in our study) the subsample of chokers' (but not the collective sample) IBs served to exacerbate the perceived threat (e.g., Chadha et al., 2019) already present within the situation. It is not just important and preferable (rational) that chokers succeed and garner favorable evaluation, to chokers it is a necessity, and failure to achieve is intolerable (irrational). These IBs, along with low self-presentation efficacy and protective agentic self-presentation motives (Hill et al., 2017) and the possibility of relational devaluation from coaches or selectors (e.g., Mesagno et al., 2011, 2012), may exacerbate anxiety (e.g., Turner et al., 2019). In fact, meta-analytic (Visla et al., 2016) and path-analytic (Chadha et al., 2019) evidence indicates that there is a stronger relationship between IBs and anxiety when a stressor is present, real, personally relevant (rife in real-world competitions), and cognitively evaluated as a threat (perhaps to athletic identity formation). As anxiety increases, this unhealthy negative emotion (linked to BTED) may lead chokers to avoidant behaviors, such as quicker task preparation and execution (i.e., rushing the shot), which may create self-regulatory breakdown and immediate relief and escape from the unpleasant, emotional distress (e.g., Baumeister, 1997; Jordet & Hartman, 2008). The result is a counterproductive decrease in performance.

With sport research (Wood, Barker, & Turner, 2017; Wood, Barker, Turner, & Higgins, 2017), including the current paper, indicating the relationship between IBs and performance may not be straightforward, juxtaposed against the corpus of literature indicating IBs to be deleterious for psychological wellbeing, a deeper understanding of how IBs can be utilized is warranted. Turner (2016) has suggested that athletes may partake in

"double think", which reflects "…the power of holding two contradictory beliefs in one's mind simultaneously, and accepting both of them" (Orwell, 1949, p. 32). That is, athletes may, and perhaps should, be encouraged to use IBs (in the form of self-talk) in some performance situations, while simultaneously and contradictorily holding core rational beliefs. Turner provides the example of a marathon runner in the final mile using the irrational belief, "I want to get my personal best and therefore I have to, and it would be awful if I did not", which may inspire a final burst of enthusiasm for the home straight, while at the same time harboring core rational beliefs that recognize that "I want to get my personal best, but that does not mean I have to, and it would be bad but not awful if I did not". The results of the current study indicate that this might be particularly effective for performance under conditions of low-pressure. So long as the athlete sheds the rigid and extreme performance belief when it is no longer salient, perhaps wellbeing can be maintained amidst contextual irrationality. This ability to use irrational self-talk while holding rational core beliefs relies on the athlete's meta-cognitive ability to introspect on their thought processes (Metcalfe & Shimamura, 1994), and be able to understand that different beliefs are appropriate for different circumstances. Future research could explore this possibility between self-talk and core beliefs in sport.

Limitations

One limitation of this study was the sample size. Due to difficulty in recruiting participants, the sample size was relatively small (N=35) and as such may have left the study statistically underpowered. Nevertheless, the main effect of the pressure condition was statistically significant for all three dependent variables, with large effect sizes for cognitive anxiety, somatic anxiety, and a medium effect size for performance. However, the level of performance-related IBs did not have a statistically significant direct effect on any of these variables, and nor was the effect of the pressure condition significantly moderated by the

level of IBs, although there was a significant interaction between the level of IBs and the pressure condition for the subsample of seven chokers. Given the contrasting results of this study with other IBs literature and the small sample size, this preliminary investigation on IBs should be replicated with a larger sample in order to provide more robust findings. Nevertheless, any subsample of chokers will only ever be a small sample of skilled, elite athletes because the athlete is unlikely to achieve elite status if experiencing choking consistently. Thus, whilst issues of statistical power should be considered, there is much to be gained from studying fewer participants (e.g., Normand, 2016) who present with specific performance-related issues such as choking, using repeated measures methods. Thus, these findings should be interpreted with caution. Another limitation was that arguably choking was not evident in the group analysis, but our follow-on analysis of our chokers subsample analysis may add value to the choking-specific results.

Future directions

Other than the aforementioned research directions, and considering the exploratory nature of this study, many avenues of fruitful future research exist. Based on our subsample of chokers not conforming to our expected hypothesis of increases in IBs leading to choking, one future research question could be why did the seven chokers within a moderate level of IBs have a larger decrease in performance than those higher in IBs? Furthermore, why did the chokers (with moderate IB levels) decrease performance, whereas the other participants in the collective analysis "coped" with the situation, especially when the collective analysis exhibited increases in anxiety overall? These questions may possibly be answered by future researchers adding cognitive appraisal elements and investigating the interaction between IBs, cognitive appraisal, and pressure.

Irrational and rational beliefs are both heavily influential in emotional control (David et al., 2009) and though they appear to be two ends of a bipolar spectrum, they are instead

orthogonal, with a single activating event capable of creating both irrational and rational beliefs specific to it (David et al., 2009). Analyzing both belief types in athletes in high-pressure situations may enhance understanding regarding how the different types, and levels, of irrational and rational beliefs interplay during performance. This research could reveal which beliefs are associated with functional emotional responses (and positive emotional perceptions) and help athletes to perform well under pressure and which IBs may hinder performance under pressure. Thus, the incorporation of both irrational and rational beliefs may enable researchers to identify what beliefs may predispose, or protect against, choking, and would enable researchers to investigate whether the proportion of rational beliefs compared to irrational beliefs is more salient than rational and irrational beliefs alone.

Applied implications for sport psychologists

There are (at least) two applications for sport psychologists to consider as a result of this study: choking-based and consideration for applied consulting. First, choking is likely more than just working with athletes to maintain appropriate attentional focus especially if evidence of the self-presentation model of choking (Mesagno et al., 2011, 2012) exists. Thus, using clinical psychology-based methods to deal with dysfunctional thinking may help to improve performance. For example, some researchers (e.g., Hill et al., 2017) have suggested that applied sport psychologists may consider using REBT with athletes who experience choking "to contest the underlying beliefs that have led to the low expectations and protective-agentic motives" (p. 148). Exploring the underlying reasons for the self-presentation issues athletes may have will uncover fruitful interventions to help athletes perform better under pressure.

Second, this study shows the complex influence that core beliefs may have on choking. Based on this complexity, applied sport psychologists should control their own self-determined IB biases (i.e., if IBs are helpful for anxiety and performance). Instead, discuss

how irrational and rational beliefs influence athlete performance and emotions and develop tailored, individualistic choking intervention strategies based on the beliefs of individual athletes. In REBT, IBs are deemed to be irrational in part by whether the belief is pragmatic or useful. The emergent idea that IBs can be helpful for performance is important because practitioners may resist disputing such IBs, given the potential utility of these beliefs for goal attainment.

To expand, an IB is considered so because it is false, illogical, and unhelpful for goal attainment. Since IBs are deleterious for mental health (Visla et al., 2016), the extent to which IBs are helpful or unhelpful are in part dependent on the goal. If the goal of an individual is to have a functional and healthy life that is minimally affected by psychological distress, then the evidence indicates to reduce those IBs because they are not helpful for the goal of a healthy life. If, however, the goal is to succeed in the short-term (e.g., in a current sporting endeavor), then perhaps IBs are not so irrational because they could help the person achieve the short-term goal. In other words, if the goal is a content life punctuated by good health and wellbeing, then having an IB cannot be considered helpful and thus retains its 'irrational' definition. If the goal is to achieve a short-term goal, then there is some evidence that having IBs could be useful, thus perhaps shedding the 'irrational definition'. In the current study, it may not be IBs per se that was problematic for performance, rather, it may be how IBs affected performance under high pressure that was most striking. Practitioners should be cautious when deciding whether to dispute athlete IBs given the differential performance effects, and the mental health risks associated with high IBs (Turner, 2016). Turner (2019) suggests that helping athletes to develop 'double think' cognitive skills may help them to adopt beliefs that aid goal attainment even if they are 'irrational', but still recognize the false and illogical nature of those beliefs. Encouraging the athlete to develop a rational philosophy of life, while helping them to safely use IBs in acute performance

scenarios, may have some practical utility. Researchers should investigate the contextual belief choices athletes make to more fully understand how IBs can be safely used for performance, while also ensuring that functional mental health is a focus. For example, in light of the results of the current study, it may not be a fruitful endeavor to encourage athletes to carry IBs into high pressure situations.

In essence, those applying REBT with athletes should gain clear, unambiguous understanding of whether a client's IBs are indeed unhelpful for performance, and if they find that IBs are driving performance attainment, should decide whether the potential wellbeing costs of holding IBs is worth the potential performance gains (Turner, 2016). Sport psychologists should delve into the belief structures of athletes rather than question their self-talk to determine if IBs of the athlete will be effective for performance under pressure.

Conclusions

The current study has presented novel research into the relationship between state anxiety, performance, and IBs. The findings indicate that when investigating collective participant data, level of performance under pressure does not decrease with increasing generalized IBs, but for a subsample of chokers, the different pressure situations may result in opposite IB influences on performance. Due to experimental limitations, replication of this current study with larger sample sizes is highly recommended. In addition, applied research should be undertaken that focuses on using REBT with the naturally niche elite athlete population that experiences choking. Given the increasing use of REBT within sport psychology for improving performance generally (and under pressure), further research concerning the effectiveness, and use, of IBs is warranted.

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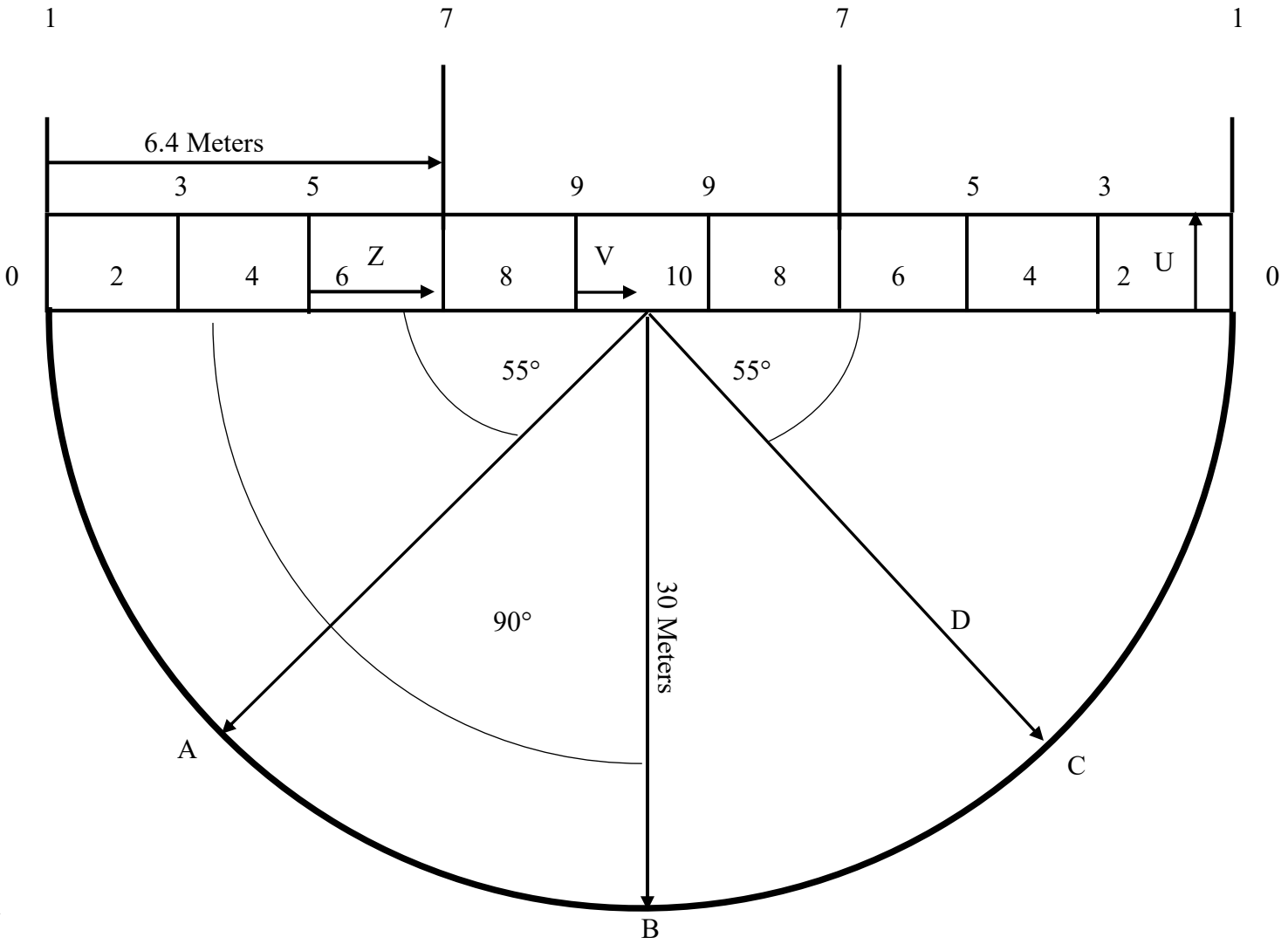

Figure 1. Performance task set up. The set kicking positions (A, B, and C) were 30 meters away from the goal line. Kicking position A and C were set on a line 55 degrees from the goal line and equidistant to kicking position B. In the high-pressure condition, a teammate stood 25 meters from the goal line (letter D), directly in front of each of the kicking positions A, B, and C.

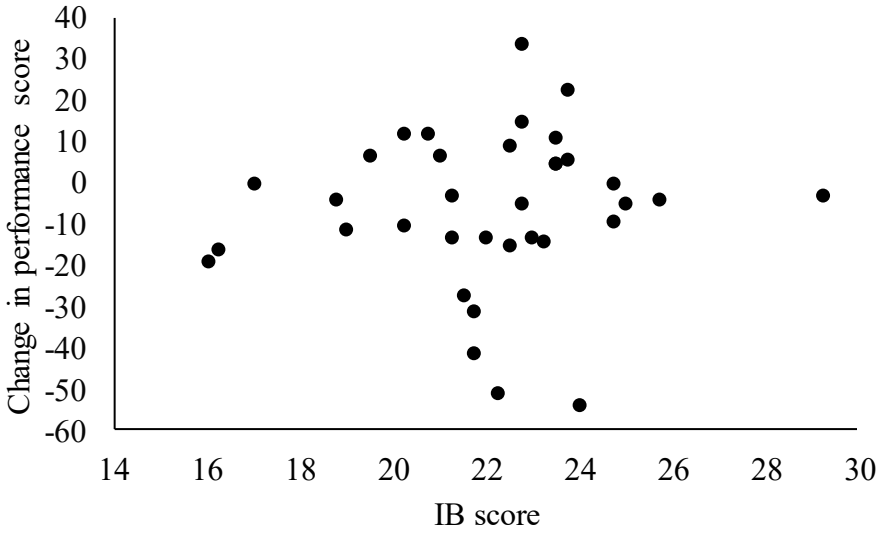

Figure 2. Scatterplot of the correlational analysis between change in performance and irrational belief (IB) score.

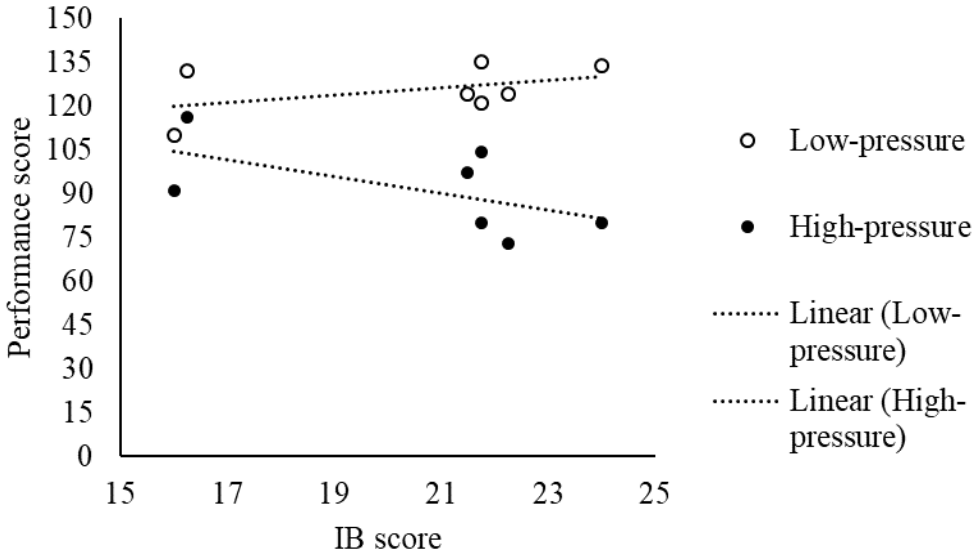

Figure 3. Relationship between performance score and IB score of seven "chokers" under low- and high-pressure conditions.

Table 1.

Overall Mean (M) and Standard Deviation (SD) of anxiety and performance scores for all participants in both Conditions.

Measure	Low pressure		High Pressure	
	M	*SD*	*M*	*SD*
Cognitive anxiety	20.26	15.55	28.19	17.93
Somatic anxiety	24.67	18.10	38.06	21.41
Performance	117.66	11.43	111.51	14.14